

OTVARANJE LABORATORIJE ZA MODELSKA DINAMIČKA ISPITIVANJA INOVACIONOG CENTRA ZA ZEMLJOTRESNO INŽENJERSTVO SISTEMA DC 90

INAUGURATION OF THE LABORATORY FOR MODEL DYNAMIC TESTING IN THE EARTHQUAKE INGENEERING INNOVATION CENTRE OF SYSTEM DC 90

Povodom dvadeset godina rada Inovacionog centra za zemljotresno inženjerstvo Sistema DC 90 i od podnošenja prve patentne prijave (P-2381/89 od 15.12.1989) je u Boleču kraj Beograda 23.09.2009. svečano otvorena laboratorija za modelska dinamička ispitivanja. Puštanju u rad laboratorije prisustvovalo je preko 150 zvanica iz Srbije, Makedonije, Bosne i Hercegovine i Crne Gore, a među njima predstavnici Ministarstva za nauku i tehnološki razvoj Srbije, Privredne komore, više fakulteta, instituta, privrednih preduzeća, inovacionih i pronalazačkih organizacija, i posebno pozvani eksperți iz ove oblasti.

U izlaganju zamenika ministra prof. Radoslava Cerovića posebno je naglašena uloga Ministarstva nauke i tehnološkog razvoja u podsticaju inovacione delatnosti.

O primeni sistema DC 90 u sanaciji objekata oštećenih zemljotresom u Kolubarskom okrugu, govorio je predsednik Inženjerske komore Srbije prof. Dragoslav Šumarac.

O ispitivanju elemenata, modela i objekata sistema DC 90 na vibroplatformi i objektima na ambijentalne i prinudne vibracije u Srbiji i svetu govorila je prof. Lidija Krstevska, saradnik Instituta za seizmičko inženjerstvo i inženjersku seismologiju (IZIIS), Skoplje, Makedonija.

Značaj poslovno-tehnološkog Inkubatora Centra tehničkih fakulteta iz Beograda u razvoju preduzeća za inovativne proizvode je bila tema izlaganja Gordane Danilović-Grković, direktora Inkubator Centra.

U ime Sistema DC 90 je predsednik Saveta Zoran Petrašković uručio zlatne plakete za doprinos razvoju inovatorstva prof. Radoslavu Ceroviću, prof. Dragoslavu Šumarcu, prof. Lidiji Krstevskoj, prof. Stojanu Sedmaku, akademiku SAIN Milošu Katiću i dipl. inž. građevine Dobrici Vasiljeviću.

Razvijena laboratorijska oprema je puštena u rad ispitivanjem kvazidinamičkim opterećenjem „Vokzal“ dampera, sa dijagonalom za bezgredne skeletne sisteme, na kidalici sile ± 5000 kN i pomeranja 535 mm. Rad vibroplatforme za dinamička ispitivanja i ponašanje pri rezonanci je prikazan na modelima različitih konstrukcija.

Laboratorija je namenjena da služi domaćim i stranim ekspertima u istraživanju za osvajanje novih ili nastavak sopstvenog procesa razvoja i uvođenje inovacija za povećanje sigurnosti građevinskih konstrukcija na zemljotresne potrese. Svoje ideje istraživač može realizovati i proveriti na modelima u laboratoriji Inovacionog centra i upoznati se sa savremenim konstrukcijskim sistemima zasnovanim na inovacijama i posebnim konstrukcijama uređaja za upravljanje i kontrolu sigurnosti objekata na potrese zemljotresa.

U toku rada na istraživanju i ispitivanju biće dostupne eksertske usluge saradnika Instituta IZIIS iz Skoplja, prof. Ljubomira Taškova i prof. Lidije Krstevske, za probleme dinamike, i prof. Stojana Sedmaka, saradnika Tehnološko-metalurškog fakulteta iz Beograda, za probleme zamora i mehanike loma.

In the occasion of twenty years of operation of The Earthquake Engineering Innovation Centre of System DC 90 and submission of first patent application (P-2381/89 on 15.12.1989) in Boleč near Belgrade on 23.09.2009 the opening ceremony of The laboratory for model dynamic testing was held. Introduction in its operation attended more than 150 guests from Serbia, Macedonia, Bosnia & Herzegovina and Montenegro, among them representatives of the Serbian Ministry of Science and Technological Development, Chamber of Commerce, many faculties, institutes, companies, innovation and deviser organisations, and invited experts in the field.

In the exposure of Prof. Radoslav Cerović, deputy minister, the role of Ministry of Science and Technological Development in support to innovation activity is accentuated.

The use of system DC 90 for the retrofit of objects damaged in Kolubara region earthquake was the topic of Prof.. Dragoslav Šumarac, head of Engineering Chamber.

The testing of elements, models and objects of DC 90 system on vibrating platform and objects by ambient and forced vibration in Serbia and worldwide was presented by Prof. Lidija Krstevska, the Institute of Seismic Engineering and Engineering Seismology (IZIIS), Skopje, Macedonia.

The importance of Business Technology Incubator of Technical Faculties in Belgrade in founding of companies for innovative products was the theme of the exposure of Gordana Danilović-Grković, Incubator director.

On behalf of System DC 90 Zoran Petrašković, board president, presented Gold Medals for contribution in innovation movement development to Prof. Radoslav Cerović, Prof. Dragoslav Šumarac, Prof. Lidija Krstevska, Prof. Stojan Sedmak, SAIN academician Miloš Katić, and civil engineer Dobrica Vasiljević.

Developed laboratory equipment has been inaugurated by quasi-dynamic testing of damper “Vokzal”, with the diagonal for girderless frame system, on the testing machine of force capacity ± 5000 kN and 535 mm stroke. Operation of vibrating platform for dynamic testing and behaviour at resonance is presented on models of different structures.

The laboratory is intended to serve to domestic and foreign experts in research to create new or continue own development process and involve innovations for security increase of engineering structures to earthquake shocks. The researcher can effectuate the ideas and test them on models in Innovation Centre laboratory and be acquainted with updated structural systems based on innovations and specially designed devices for handling and control of object security on earthquake shocks.

In the course of research and testing experts support will be assured from Institute IZIIS, Skopje, by Prof. Ljubomir Taškov and Prof. Lidija Krstevska, for dynamics problems, and from the Faculty of Technology and Metallurgy, Belgrade, by Prof. Stojan Sedmak, for fatigue and fracture mechanics problems.

Nosioci zlatne plakete Sistema DC 90 za doprinos razvoju inovatorstva
 The bearers of Gold Medal of the System DC 90 for contribution in innovation movement development



Radoslav Cerović



Dragoslav Šumarac



Lidija Krstevska



Stojan Sedmak



Miloš Katić



Dobrica Vasiljević



Srpska akademija izumitelja dodelila je diplomu pronalazaču Zoranu Petraškoviću
 The Academy of Inventors of Serbia presented diploma to inventor Zoran Petrašković

Zahvalnica Društva intelektualaca "Braća Tan" i diploma Oklevel su dodeljeni autoru sistema DC 90
 The recognition of Society of Intellectuals "Brothers Than" and diploma Oklevel are donated to author of system DC 90



Veliki broj zvanica je učestvovao na puštanju u rad laboratorije Sistema DC 90
A large number of invited had participated the inauguration of the System DC 90 laboratory



Lokacija laboratorije Sistema DC 90
Location of System DC 90 laboratory



Ispitivanje kvazidinamičkim opterećenjem „Vokzal“ dampera, sa
dijagonalom za bezgredne skeletne sisteme, na kidalici sile
 ± 5000 kN i pomeranja 535 mm

Quasi-dynamic testing of “Vokzal” damper with the diagonal for
girderless frame system, on the testing machine of force capacity
 ± 5000 kN and 535 mm stroke



Rad vibroplatforme za dinamička ispitivanja i ponašanje pri
rezonanci je prikazan na modelima različitih konstrukcija
Operation of vibrating platform for dynamic testing and behaviour
at resonance is presented on models of different structures

Jasminka Petrašković-Džuklevski
Zoran Petrašković

PRIKAZ LABORATORIJE ZA MODELSKA DINAMIČKA ISPITIVANJA INOVACIONOG CENTRA ZA ZEMLJOTRESNO INŽENJERSTVO SISTEMA DC 90

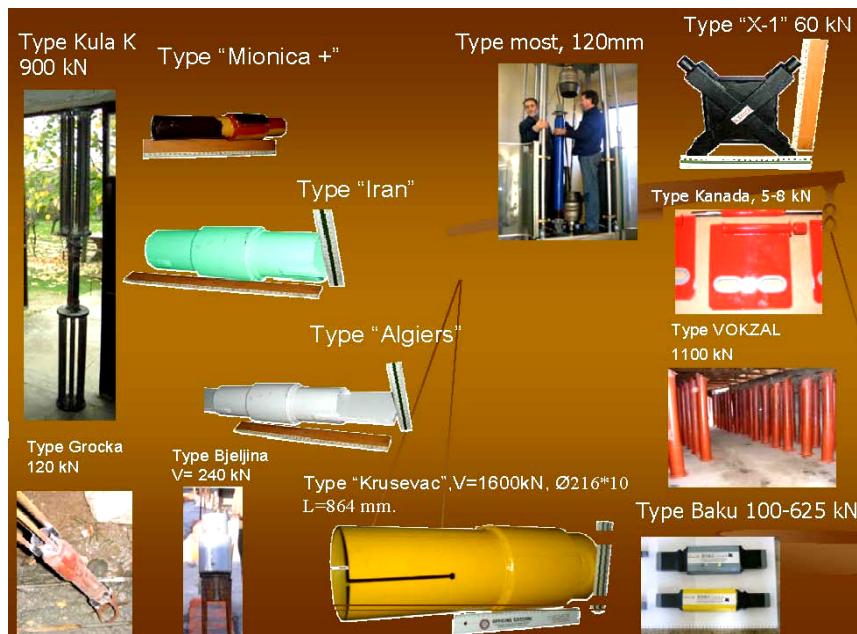
PRESENTATION OF THE LABORATORY FOR MODEL DYNAMIC TESTING IN THE EARTHQUAKE INGENEERING INNOVATION CENTRE OF SYSTEM DC 90

Uvođenju novog rešenja prigušivanja udara seizmičkog opterećenja u praktičnu primenu prethodio je konceptualni razvoj, zasnovan na niskocikličnom zamoru i plastičnoj deformaciji čeličnih dampera, kao i projektovanje i konstruisanje sistema na objektu koji se štiti ili sanira posle oštećenja. Najznačajnija komponenta u sistemu je damper, kako u pogledu projektnog rešenja, tako i u pogledu dokaza o njegovoj funkcionalnosti, /1-3/. To zahteva obimna ispitivanja, koja treba osmisliti i izvesti.

U početnoj fazi razvoja dampera, kao i u toku usavršavanja konstrukcija, dragocena je bila saradnja Sistema DC 90 sa Institutom za seizmičko inženjerstvo i inženjersku seismologiju (IZIIS), Skoplje, Makedonija, sa Vojnotehničkim institutom (VTI), Beograd, Institutom za ispitivanje materijala (IMS), Beograd, Univerzitetom u Ljubljani, Fakultet za građevinarstvo i geodeziju, Ljubljana, Slovenija, i Nacionalnim centrom za primenjena istraživanja u zemljotresnom inženjerstvu, Alžir, kao i ispitivanja, izvedena u saradnji sa stručnjacima iz tih institucija. Koliko je problema prisutno može se zaključiti iz assortmana razvijenih tipova dampera (sl. 1).

The introduction of the new solution for damping of seismic loading shocks in practical applications is foregone by the conception development, based on steel damper low cycle fatigue and plastic deformation, as well as design and construction of systems on the object to be protected or retrofitted after damage. The most important component in the system is the damper, both regarding design solution and proof on its functionality, /1-3/. This imposes extended testing, which should be conceptualized and performed.

In the early stage of damper development and during design improvement, valuable collaboration has been established between System DC 90 and the Institute of Seismic Engineering and Engineering Seismology (IZIIS), Skopje, Macedonia, Military Technical Institute (VTI), Belgrade, Institute for Materials Testing (IMS), Belgrade, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Ljubljana, Slovenia, and The National Centre of Applied Research in Earthquake Engineering (CGS), Algeria, and testing performed jointly with the experts from these institutions. It is possible to guess from developed damper types assortment how many problems are met (Fig. 1).



Slika 1. Asortiman razvijenih dampera Sistema DC 90
Figure 1. Assortment of developed dampers in System DC 90.

Za dalja ispitivanja inovacija u pogledu uticaja zemljotresa bilo je potrebno razviti specijalnu opremu. Pre svega je na osnovu stečenog iskustva definisan projektni zadatak, a u narednoj fazi je uključen veliki broj saradničkih institucija i stručnjaka potreban za ostvarenje ovakvog uređaja. Tako je razvijen koncept i izrađen jedinstveni hidraulički sistem zatvorene petlje za modelska dinamička ispitivanja i ispitivanja velikim promenljivim opterećenjima dampera i modela objekata.

For further testing of innovations regarding earthquake effects, new special equipment was necessary. First of all, project requirements are defined based on gathered experience, and in the next phase a great number of cooperative institutions and experts is involved, that are necessary for the accomplishment of such a device. In this way the concept is developed and a unique hydraulic closed-loop system is constructed for model dynamic testing and testing by high variable loads of dampers and object models.

Autor koncepta je Zoran Petrašković, saradnik firme Sistem DC 90, Beograd, uz konsultaciju prof. Ljubomira Taškova i prof. Lidije Krstevske, saradnika IZIIS. Razrada projekta je poverena Žarku Petraškoviću. Izradu delova, proizvodnju komponenti i sklopova, kao i montažu sistema vodio je Slobodan Radivojević, saradnik preduzeća „Radius“, Mionica. Hidraulični cilindri su isporučeni prema posebnoj specifikaciji od strane stručnjaka, koji su posle odlaska iz preduzeća „Prva petoljetka“, Trstenik, nastavili da se bave istim poslom u sopstvenom preduzeću. S obzirom na uslove i mogućnosti, ugrađena je oprema dostupna na tržištu kada je to bilo moguće, a razvoj specifičnih uređaja je delo domaćih eksperata, shodno postavljenom projektnom zadatku. Servo ventil američke firme MTS nabavljen preko Italije, a firma AFS, Beograd, i njeni stručnjaci, Dragan Nauparac i Zoran Nikolić, su obezbedili hidrauličnu opremu. Softver za upravljanje sistemom je projekt Mikana Radivojevića. Senzori za merenje pomerenja i merenje ubrzanja sa komponentama nabavljenim u SAD su obezbeđeni preko Josifa Jordanovskog, saradnika firme M3E-EKA, Makedonija. Sistem za stalni nadzor (oskultaciju) je razvijen uz pomoć Tina Mihajlovića i Saša Atanasovskog, saradnika iz Makedonije, firme Digitexx, SAD.

Izgled kidalice tokom postavljanja i završne montaže je prikazan na sl. 2.



Slika 2. Hidraulična kidalica sa zatvorenom petljom: aksijalna promenljiva sila do ± 5000 kN i pomeranje do ± 265 mm, sa vertikalnim okvirom za gabarite do $5000 \times 3000 \times 1000$ mm, postavljena na otvorenom

Figure 2. Hydraulic closed-loop testing machine: axial variable force to ± 5000 kN and displacements up to ± 265 mm, with a vertical frame for $5000 \times 3000 \times 1000$ mm samples, located outdoors.

Postavljanje kidalice – Erection of testing machine

Izveden i pušten u pogon hidraulični sistem sa bitnim elementima savremenog rukovanja se može koristiti za ispitivanja u pet dispozicija.

1) To je vibroplatforma, 800×2400 mm, za modele mase do 1 tone i za dinamičko opterećenje u proizvoljnem vremenu, frekvencije do 15 Hz, pri pomeranjima ± 30 mm.

The author of the concept is Zoran Petrašković, company System DC 90, Belgrade, with Prof. Ljubomir Taškov and Prof. Lidija Krstevska, IZIIS co-workers, serving as consultants. Project elaboration was confined to Žarko Petrašković. Elements manufacturing, production of components and sub-assemblies, and final assembling had been managed by Slobodan Radivojević, company "Radius" Mionica. Hydraulic cylinders were delivered, following special specification by the experts, which continue with the same business in their own company after leaving the well known "Prva petoljetka", Trstenik. Obeying the conditions and opportunities, the accessories available on the market were built-in when possible, and the development of specific devices was the task of domestic experts, based on specified project requirements. The American company MTS servo valve was supplied via Italy and AFS, Belgrade, and its experts, Dragan Nauparac and Zoran Nikolić, supplied hydraulic devices. Software for system control is a project of Mikan Radivojević. Sensors for displacement and acceleration measurements with component procured from USA were assured by Josif Jordanovski, company M3E-EKA, Macedonia. Tino Mihajlović and Sašo Atanasovski, co-workers from Macedonia of the company Digitexx, USA, helped the development of the auscultation system.

The testing machine during erection and final assembly is presented in Fig. 2.



Završna montaža – Final assembly

Produced and put into operation the hydraulic system with substantial elements of updated control can be applied in five dispositions.

1) This is the vibrating platform, 800×2400 mm, for the model of up to 1 ton mass and dynamic loading in optimal time, frequency up to 15 Hz, at the displacements ± 30 mm.

2) Aksijalno dinamičko ispitivanje promenljivim opterećenjem pritisak–zatezanje u ramu elemenata dužine do 2000 mm silama do ± 20 kN uz frekvenciju do 15 Hz i pomeranja ± 30 mm.

3) Ispitivanje modela u vertikalnom ramu gabarita 3000×2500 mm aktuatorom za horizontalna dinamička dejstva navedenih dinamičkih karakteristika.

4) Ispitivanje na vertikalna dinamička opterećenja linjskih konstrukcija gabarita $600 \times 2000 \times 3000$ mm aktuatorom navedenih dinamičkih karakteristika.

5) Kvazidinamičko ispitivanje elemenata konstrukcije gabarita $5000 \times 3000 \times 1000$ mm promenljivim opterećenjem pritisak–zatezanje u vertikalnom ramu maksimalnom silom ± 5000 kN, uz pomeranja do ± 265 mm.

Tokom svečanog puštanja hidrauličnog sistema u pogon demonstrirane su neke mogućnosti primene, ovde ilustrovane, sl. 3-5.

2) Uniaxial dynamic testing by variable loading in tension-compression in the frame of elements in length up to 2000 mm by forces to ± 20 kN at frequency to 15 Hz and displacements ± 30 mm.

3) Model testing in vertical frame sized 3000×2500 mm using actuators for horizontal dynamic loading of specified dynamic characteristics.

4) Testing by vertical dynamic loading of linear structures sized $600 \times 2000 \times 3000$ mm using actuators of specified dynamic characteristics.

5) Quasi-dynamic testing of structural components in size $5000 \times 3000 \times 1000$ mm by variable loading in tension-compression by maximal force of ± 5000 kN, and displacements up to ± 265 mm, applying a vertical frame.

During ceremonial inauguration of the hydraulic system some of possible applications had been demonstrated, here illustrated in Figs. 3-5.



Slika 3. Ispitivanje dampera tipa Vokzal na kidalici 5000 kN
Figure 3. Testing of damper type Vokzal on the testing machine 5000 kN.



Slika 4. Hidraulična kidalica sa zatvorenom petljom: aksijalna promenljiva sila do ± 20 kN i pomeranje do ± 30 mm, ispitni uzorci dužine do 2000 mm, uz frekvenciju do 15 Hz, kombinovana sa vibroplatformom 800×2400 mm za modele mase do 1 tone

Figure 4. Hydraulic closed-loop testing machine: axial variable force to ± 20 kN and displacements up to ± 30 mm, testing samples to 2000 mm in length, at frequency up to 15 Hz, combined with vibrating platform 800×2400 mm for models of 1 ton in mass.

Izgled sistema – View of the system

Neke od navedenih dispozicija su zahtevale dodatna rešenja. Tako je za vibroplatformu bilo potrebno posebno projektovati vertikalni zid (sl. 6), na koji su postavljeni horizontalni aktuatori ± 20 kN.



Pult za kompjutersko upravljanje – Computerised control desk

Some of presented dispositions required additional solutions. It was necessary to design special vertical wall (Fig. 6), on which horizontal actuators of ± 20 kN could be positioned.

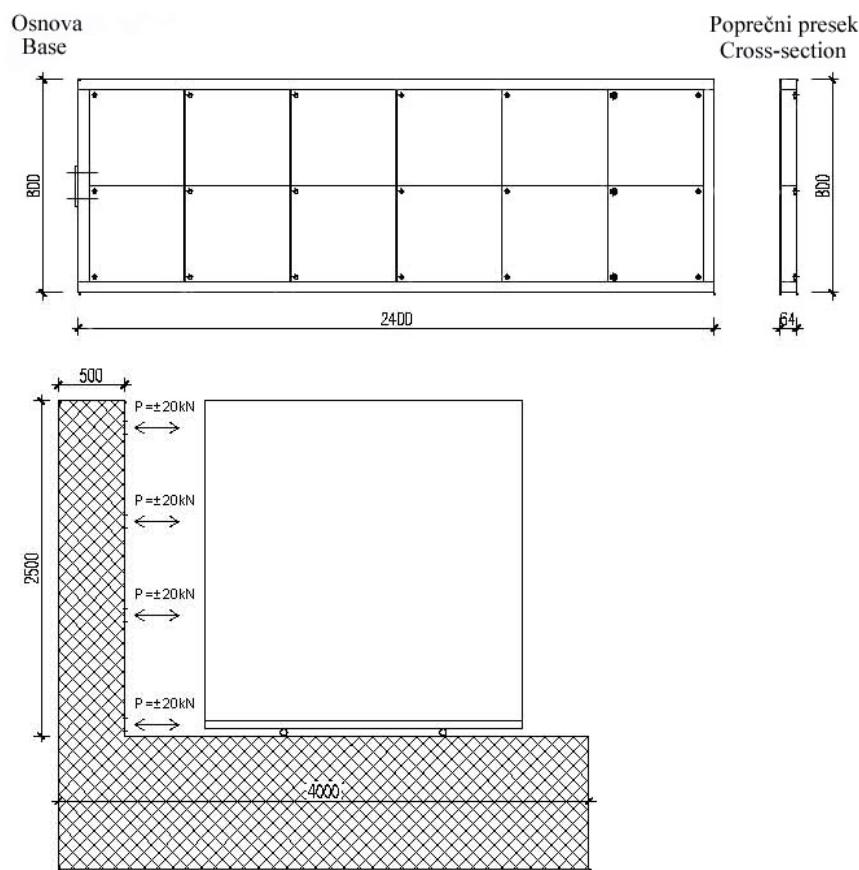


Slika 5. Vibroplatforma u radu
Figure 5. Vibrating platform in operation.

Opšti izgled – General view



Ispitivanje modela – Testing of models



Slika 6. Shema konstrukcije temelja vibroplatforme (gore: vibroplatforma; dole: vertikalni zid sa horizontalnim aktuatorima)
Figure 6. Design scheme of vibrating platform foundation (above: vibrating platform; below: vertical wall with horizontal actuators).

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Zoran Petrašković
Stojan Sedmak

INOVACIJE I SIGURNOST 2009 – PRVA LETNJA KOLONIJA INOVACIONOG CENTRA ZA ZEMLJOTRESNO INŽENJERSTVO SISTEMA DC 90

INNOVATION AND SECURITY 2009 – FIRST SUMMER COLONY OF THE INNOVATION CENTER FOR EARTHQUAKE ENGINEERING OF SYSTEM DC 90

Prva letnja istraživačka kolonija „Inovacije i sigurnost 2009“ u organizaciji Inovacionog centra za zemljotresno inženjerstvo Sistema DC 90 je održana u periodu 22. do 27. septembra 2009.

Istraživačka kolonija je pre svega namenjena studentima, inženjerima i specijalistima, koji žele da se upoznaju i osvoje nove procese stvaranja inovacija ili da prošire takve već započete procese radi povećanja sigurnosti građevinskih konstrukcija na zemljotresne potrese. Svoje ideje mogu realizovati i eksperimentalno proveriti na modelima u novo osnovanoj i otvorenoj laboratoriji Inovacionog centra, opremljenoj savremenom specijalno projektovanom opremom. Na taj način se učesnici mogu upoznati sa konstrukcijskim sistemima zasnovanim na inovacijama i sa posebnim projektima uređaja za upravljanje i kontrolu sigurnosti objekata izloženih udaru zemljotresa, kakvi su metalni histerezisni ili visokoelastični damperi, seizmički izolatori, uređaji zavisni od brzine ili pomeranja, uređaji za krute veze.

Prva inovaciona kolonija je okupila stručnjake i inženjere iz Srbije, Makedonije, Crne Gore i Bosne i Hercegovine. O programu rada kolonije, izboru učesnika i realizaciji brinuo je autorski tim u sastavu:

- Prof. Dragoslav Šumarac, Građevinski fakultet, Beograd
- Prof. Ljubomir Taškov, Institut za seizmičko inženjerstvo i inženjersku seismologiju (IZIIS), Skoplje, Makedonija
- Prof. Lidija Krstevska, Institut za seizmičko inženjerstvo i inženjersku seismologiju (IZIIS), Skoplje, Makedonija
- Prof. Stojan Sedmak, Tehnološko-metalurški fakultet, Beograd
- Prof. Zlatko Maglajić, Građevinski fakultet, Sarajevo, BiH
- Gordana Danilović-Grković, Poslovno-tehnološki Inkubator Centra tehničkih fakulteta, Beograd
- Zoran Petrašković, član Akademije izumitelja Srbije, Beograd

U radu kolonije su učestvovali:

- Dobrica Vasiljević, dipl. grad. inž.
- Emina Kostić, dipl. grad. inž.
- Željko Knežević, dipl. grad. inž.
- Novica Jančić, dipl. grad. inž.
- Vera Vujović, dipl. grad. inž.
- Marijana Andđelković-Trbojević, dipl. grad. inž.
- Jelena Ostojić, dipl. grad. inž.
- Zoran Perović, dipl. grad. inž.
- Tino Mihajlović, dipl. grad. inž.
- Sašo Atanasovski, dipl. grad. inž.
- Simon Sedmak, student

Prvi deo kolonije je lociran u laboratoriji Inovacionog centra u Boleču – Ritopeku kraj Beograda.

Prvog dana rada kolonije su održana uvodna izlaganja.

The First Summer Research Colony “Innovation and security 2009”, organised by The Innovation Centre for Earthquake Engineering of System DC 90 took place from 22 to 27 September 2009.

The Research Colony is aimed, first of all, to students, engineers, and experts, wishing to be acquainted and to accept new procedures for innovation development or to extend such already started procedures in order to increase civil engineering structures security against earthquake shocks. They can realize their own ideas and experimentally check on models in the new founded and open laboratory of The Innovation Centre, equipped by updated specially designed devices. In this way participants can be involved in structural systems based on innovations, and special design of devices for handling and security control of objects exposed to earthquake shock, like the metallic hysteresis or super elastic dampers, seismic insulators, devices dependent on velocity or displacement, rigid connection devices.

The First Innovation Colony attracted experts and engineers from Serbia, Macedonia, Montenegro, and Bosnia & Herzegovina. The care for the colony programme, on the selection of participants and the realization was envisaged by the following authors' team:

- Prof. Dragoslav Šumarac, Civil Engineering Faculty, Belgrade
- Prof. Ljubomir Taškov, Institute of Seismic Engineering and Engineering Seismology (IZIIS), Skopje, Macedonia
- Prof. Lidija Krstevska, Institute of Seismic Engineering and Engineering Seismology (IZIIS), Skopje, Macedonia
- Prof. Stojan Sedmak, Faculty of Technology and Metallurgy, Belgrade
- Prof. Zlatko Maglajić, Civil Engineering Faculty, Sarajevo, BH
- Gordana Danilović-Grković, Business Technology Incubator of Technical Faculties, Belgrade
- Zoran Petrašković, member of the Academy of Inventors of Serbia, Belgrade

Also participating in the colony work:

- Dobrica Vasiljević, dipl. civil. eng.
- Emina Kostić, dipl. civil. eng.
- Željko Knežević, dipl. civil. eng.
- Novica Jančić, dipl. civil. eng.
- Vera Vujović, dipl. civil. eng.
- Marijana Andđelković-Trbojević, dipl. civil. eng.
- Jelena Ostojić, dipl. civil. eng.
- Zoran Perović, dipl. civil. eng.
- Tino Mihajlović, dipl. civil. eng.
- Sašo Atanasovski, dipl. civil. eng.
- Simon Sedmak, student

The first part of the colony was held in the laboratory of the Innovation Centre in Boleč – Ritopek near Belgrade.

Introductory expositions were held on the first day.



Sala laboratorije Inovacionog centra Sistema DC 90, Boleč
Hall in laboratory of Innovation Centre System DC 90, Boleč



Izlaganje S. Sedmaka „Neki aspekti zamora materijala“
Expose of S. Sedmak “Some aspects of material fatigue”



Lj. Taškov



L. Atanasovska

Prof. Lj. Taškov i prof. L. Atanasovska su razradili temu „Eksperimentalne metode dinamičkog ispitivanja objekata u laboratoriji i na samim objektima“ sa posebnim akcentom na analizu i prezentaciju rezultata ispitivanja i na najnovije trendove i pristupe u svetu pri zaštiti istorijskih objekata.

Prof. Lj. Taškov and Prof. L. Atanasovska elaborated the topic “Experimental methods of object dynamic testing in laboratory and in situ” with the accent to test results analysis and presentation and new trends and approaches world wide in the protection of historical objects.



Predavanje Z. Maglajića „Dinamika konstrukcija sa specifičnim aspektima pristupa u građevinskoj praksi“
Lecture of Z. Maglajić “Dynamic of structure with accent given to special approach aspect in civil engineering practice”



Izlaganje Z. Petraškovića „Inovacije uređaja i opreme u građevinarstvu“ – istraživanje, ispitivanje, izrada modela i prototipa, primena, je uključilo i demonstraciju rada vibroplatforme ispitivanjem dva modela visokih zgrada i modela objekta sa masom na vrhu. Uočene su razlike u ponašanju ramova bez ukrućenja, sa ukrućenjima, i pri kontroli deformacija. Rezultati su analizirani kompjuterski. Predstavljeni su primeri primene pristupa Sistema DC 90 na različitim objektima širom sveta.

Presentation of Z. Petrašković “Innovation of devices and equipment in civil engineering” – investigation, testing, manufacturing of models and prototypes, application, has included demonstration of the vibrating platform operation by testing two high buildings models and a model with the mass on the top. Differences are obvious in the behaviour of non-stiffened frame, stiffened frame, also with displacement control. Results were analysed by computer. The examples of worldwide application of System DC 90 approach on different objects are also presented.

Poseta Poslovno-tehnološkom inkubatoru Centra tehničkih fakulteta iz Beograda drugog dana rada kolonije je učesnicima omogućila da se upoznaju sa ljudima koji u praksi spajaju dostignuća nauke i inovacija do razvoja novih preduzeća za inovativne proizvode, na primerima različitih proizvoda. Ovaj susret je ostavio dubok utisak.

The visit to Business Technology Incubator of Technical Faculties, Belgrade, on the second day of colony work enabled the participants to be acquainted with people who connect practical achievements in science and innovations up to development of new companies for innovative products, with the examples of different products. Impressions after this meeting were very deep.



Poseta arheološkim nalazištima Vinča je omogućila opuštanje učesnika kolonije u prirodnom ambijentu

The visit to archaeological locations in Vinča enabled the participants to relax in a natural ambient



Drugi deo rada kolonije je lociran, na Dunavu, na oko 150 km od Beograda, u Dobri kraj Golupca. Okruženi šumom, uz zvuke talasa Dunava, učesnici su analizirali rezultate eksperimentalnih istraživanja i saznanja stečenih o sistemu DC 90. To je otvorilo put za razvoj novih ideja.

The second part of the colony work was located at the Danube river, about 150 km from Belgrade, in Dobra near Golubac. In the forest environment, with the sound of Danube waves, participants analysed the results of experimental research and knowledge gathered about the System DC 90. This opened the way for new ideas.



Ostvarenom saradnjom i novim poznanstvima otvoren je put za brže i lakše uvođenje inovacija. Tome je doprinela i rekreacija na putu ka vrhovima Đerdapskih brda, sastavni deo sadržaja kolonije

By realized cooperation and new acquaintances, the way to involve innovations faster and easier is opened. The walk to the Djerdap hill tips, part of colony content, contributed to this goal.



Jasminka Petrašković-Džuklevski